

What is claimed is:

1. A bone cement mixing apparatus, comprising:

a handle;

5 an input gear which is caused to rotate about a central axis in
response to rotation of said handle, wherein (i) said input gear includes a
first input gear teeth set and a second input gear teeth set, (ii) said first
input gear teeth set is spaced a first radial distance from said central axis,
(iii) said second input gear teeth set is spaced a second radial distance
10 from said central axis, (iv) said second radial distance is greater than said
first radial distance, (v) said first input gear teeth set extends outwardly
away from said central axis, and (vi) said second input gear teeth set
extends inwardly toward said central axis;

an intermediate gear, wherein said input gear is configured so that
15 during rotation thereof (i) said first input gear teeth set meshingly
engages said intermediate gear during a first period of time, and (ii) said
second input gear teeth set meshingly engages said intermediate gear
during a second period of time which is different from said first period of
time;

20 an output gear which is caused to rotate in response to rotation of
said intermediate gear; and

a mixing blade which is caused to rotate in response to rotation of
said output gear.

2. The bone cement mixing apparatus of claim 1, further comprising:

a first gear housing portion; and

5 a second gear housing portion,

wherein a gear chamber is defined when said first gear housing portion is secured to said second gear housing portion,

wherein said input gear, said intermediate gear, and said output gear are positioned within said gear chamber, and

10 wherein said handle and said mixing blade are positioned outside of said gear chamber.

3. The bone cement mixing apparatus of claim 1, wherein:

said central axis lies in a plane which divides said input gear into a
15 first input gear side and a second input gear side,

said input gear is configured so that (i) said first input gear teeth set is positioned entirely on said first input gear side, and (ii) said second input gear teeth set is positioned entirely on said second input gear side.

20 4. The bone cement mixing apparatus of claim 1, wherein:

said mixing blade includes a shaft and a number of vanes extending outwardly from said shaft, and

said shaft is aligned with said central axis.

5. The bone cement mixing apparatus of claim 1, wherein said intermediate gear rotates about an offset axis which is spaced apart from said central axis.

5 6. The bone cement mixing apparatus of claim 2, wherein:
said intermediate gear rotates about an offset axis which is spaced apart from said central axis,

 said second gear housing portion includes a post which is aligned with said offset axis, and

10 said intermediate gear includes an aperture which receives said post so as to rotatably couple said intermediate gear to said second gear housing portion.

 7. The bone cement mixing apparatus of claim 1, wherein said
15 intermediate gear meshingly engages said output gear.

 8. The bone cement mixing apparatus of claim 1, wherein said output gear is caused to rotate about said central axis in response to rotation of said intermediate gear.

20

 9. The bone cement mixing apparatus of claim 1, wherein said input gear is non-rotatably secured to said handle.

10. The bone cement mixing apparatus of claim 1, wherein:
said input gear has a ring-shaped slot defined therein,
said intermediate gear includes a post which is received within said
ring-shaped slot,
5 said post is located in said slot during rotation of said input gear.

11. The bone cement mixing apparatus of claim 1, wherein:
said intermediate gear is driven in a first direction of rotation during
said first period of time,
10 said intermediate gear is driven in a second direction of rotation
during said second period of time, and
 said first direction of rotation is opposite to said second direction of
rotation.

12. The bone cement mixing apparatus of claim 11, wherein said
15 input gear travels in said second direction of rotation during both said first
period of time and said second period of time.

13. The bone cement mixing apparatus of claim 1, wherein:

said intermediate gear is driven to rotate at a first angular velocity during said first period of time,

said intermediate gear is driven to rotate at a second angular
5 velocity during said first period of time, and
said first angular velocity is less than said second angular velocity.

14. The bone cement mixing apparatus of claim 1, wherein:

said intermediate gear is driven to rotate at a first output angular
10 velocity in response to said input gear being rotated at an input angular velocity,

said intermediate gear is driven to rotate at a second output angular velocity in response to said input gear being rotated at said input angular velocity, and

15 said first angular velocity is less than said second angular velocity.

15. The bone cement mixing apparatus of claim 1, wherein:

in response to said input gear being rotated one revolution in a clockwise direction of rotation, said intermediate gear is driven (i) a first
20 rotational distance in a counterclockwise direction of rotation, and (ii) a second rotational distance in a clockwise direction of rotation, and

said first rotational distance is less than said second rotational distance.

16. The bone cement mixing apparatus of claim 15, wherein:
said intermediate gear meshingly engages said output gear, and
said output gear is non-rotatably coupled to said mixing blade.

5 17. A bone cement mixing apparatus, comprising:
a handle;
an input gear which is caused to rotate in response to rotation of
said handle,
an intermediate gear which is caused to rotate in response to
10 rotation of said input gear;
an output gear which is caused to rotate in response to rotation of
said intermediate gear; and
a mixing blade which is caused to rotate in response to rotation of
said output gear,
15 wherein, in response to said input gear being rotated one
revolution, said intermediate gear is driven (i) a first rotational distance in
a counterclockwise direction of rotation, and (ii) a second rotational
distance in a clockwise direction of rotation, and
wherein said first rotational distance is less than said second
20 rotational distance.

18. The bone cement mixing apparatus of claim 17, wherein:
said intermediate gear meshingly engages said output gear, and
said output gear is non-rotatably coupled to said mixing blade.

5 19. The bone cement mixing apparatus of claim 17, further
comprising:

 a first gear housing portion; and

 a second gear housing portion,

 wherein a gear chamber is defined when said first gear housing
10 portion is secured to said second gear housing portion,

 wherein said input gear, said intermediate gear, and said output
gear are positioned within said gear chamber, and

 wherein said handle and said mixing blade are positioned outside
of said gear chamber.

15

 20. The bone cement mixing apparatus of claim 17, wherein said
input gear is non-rotatably secured to said handle.

21. A bone cement mixing apparatus, comprising:

a handle;

an input gear which is caused to rotate in response to rotation of
said handle,

5 an intermediate gear which is caused to rotate in response to
rotation of said input gear;

an output gear which is caused to rotate in response to rotation of
said intermediate gear; and

a mixing blade which is caused to rotate in response to rotation of
10 said output gear,

wherein said intermediate gear is driven to rotate at a first output
angular velocity during a first period of time in response to said input gear
being rotated at an input angular velocity,

wherein said intermediate gear is driven to rotate at a second
15 output angular velocity during a second period of time in response to said
input gear being rotated at said input angular velocity,

wherein said first angular velocity is less than said second angular
velocity, and

wherein said first period of time is different from said second period
20 of time.

22. The bone cement mixing apparatus of claim 21, wherein:

said intermediate gear is driven in a first direction of rotation during

said first period of time, and

said intermediate gear is driven in a second direction of rotation

5 during said second period of time,

wherein said first direction of rotation is opposite to said second
direction of rotation.

23. The bone cement mixing apparatus of claim 21, wherein:

10 said intermediate gear meshingly engages said output gear, and

said output gear is non-rotatably coupled to said mixing blade.

24. The bone cement mixing apparatus of claim 21, further

comprising:

15 a first gear housing portion; and

a second gear housing portion,

wherein a gear chamber is defined when said first gear housing
portion is secured to said second gear housing portion,

wherein said input gear, said intermediate gear, and said output
20 gear are positioned within said gear chamber, and

wherein said handle and said mixing blade are positioned outside
of said gear chamber.

25. The bone cement mixing apparatus of claim 21, wherein said input gear is non-rotatably secured to said handle.

26. A bone cement mixing apparatus, comprising:

5 an input gear which is configured to rotate about a central axis,
wherein (i) said input gear includes a first input gear teeth set and a
second input gear teeth set which are spaced apart from each other, and
(ii) said first input gear teeth set extends outwardly away from said central
axis, and (iii) said second input gear teeth set extends inwardly toward
10 said central axis;

an intermediate gear, wherein said input gear is configured so that
during rotation thereof (i) said first input gear teeth set meshingly
engages said intermediate gear during a first period of time, and (ii) said
second input gear teeth set meshingly engages said intermediate gear
15 during a second period of time which is different from said first period of
time; and

a mixing blade which is caused to rotate in response to rotation of
said intermediate gear.

27. The bone cement mixing apparatus of claim 26, further comprising an output gear, wherein:

said output gear is caused to rotate in response to rotation of said intermediate gear, and

5 said mixing blade which is caused to rotate in response to rotation of said intermediate gear.

28. The bone cement mixing apparatus of claim 27, wherein:

said intermediate gear meshingly engages said output gear, and

10 said output gear is non-rotatably coupled to said mixing blade.

29. The bone cement mixing apparatus of claim 26, further comprising:

a first gear housing portion; and

15 a second gear housing portion,

wherein a gear chamber is defined when said first gear housing portion is secured to said second gear housing portion,

wherein said input gear and said intermediate gear are positioned within said gear chamber, and

20 wherein said mixing blade is positioned outside of said gear chamber.

30. The bone cement mixing apparatus of claim 26, further comprising a handle, wherein said input gear is caused to rotate about said central axis in response to rotation of said handle.

5 31. The bone cement mixing apparatus of claim 26, wherein:
said central axis lies in a plane which divides said input gear into a first input gear side and a second input gear side,
said input gear is configured so that (i) said first input gear teeth set is positioned entirely on said first input gear side, and (ii) said second
10 input gear teeth set is positioned entirely on said second input gear side.

32. The bone cement mixing apparatus of claim 26, wherein:
said mixing blade includes a shaft and a number of vanes extending outwardly from said shaft, and
15 said shaft is aligned with said central axis.

33. The bone cement mixing apparatus of claim 26, wherein said intermediate gear rotates about an offset axis which is spaced apart from said central axis.

20

34. The bone cement mixing apparatus of claim 29, wherein:

said intermediate gear rotates about an offset axis which is spaced
apart from said central axis,

said second gear housing portion includes a post which is aligned
5 with said offset axis, and

said intermediate gear includes an aperture which receives said
post so as to rotatably couple said intermediate gear to said second gear
housing portion.

10 35. The bone cement mixing apparatus of claim 27, wherein said
output gear is caused to rotate about said central axis in response to
rotation of said intermediate gear.

36. The bone cement mixing apparatus of claim 30, wherein said
15 input gear is non-rotatably secured to said handle.

37. The bone cement mixing apparatus of claim 26, wherein:

said input gear has a ring-shaped slot defined therein,

said intermediate gear includes a post which is received within said
20 ring-shaped slot,

said post is located in said slot during rotation of said input gear.

38. The bone cement mixing apparatus of claim 26, wherein:
said intermediate gear is driven in a first direction of rotation during
said first period of time,
said intermediate gear is driven in a second direction of rotation
5 during said second period of time, and
said first direction of rotation is opposite to said second direction of
rotation.

39. The bone cement mixing apparatus of claim 38, wherein said
10 input gear travels in said second direction of rotation during both said first
period of time and said second period of time.

40. The bone cement mixing apparatus of claim 26, wherein:
said intermediate gear is driven to rotate at a first angular velocity
15 during said first period of time,
said intermediate gear is driven to rotate at a second angular
velocity during said second period of time, and
said first angular velocity is less than said second angular velocity.

41. The bone cement mixing apparatus of claim 26, wherein:

said intermediate gear is driven to rotate at a first output angular velocity during said first period of time in response to said input gear being rotated at an input angular velocity,

5 said intermediate gear is driven to rotate at a second output angular velocity during said second period of time in response to said input gear being rotated at said input angular velocity, and
 said first angular velocity is less than said second angular velocity.

10 42. The bone cement mixing apparatus of claim 26, wherein:

in response to said input gear being rotated one revolution in a clockwise direction of rotation, said intermediate gear is driven (i) a first rotational distance in a counterclockwise direction of rotation, and (ii) a second rotational distance in a clockwise direction of rotation, and

15 said first rotational distance is less than said second rotational distance.

43. A bone cement mixing apparatus, comprising:

an input gear which is configured to rotate about a central axis,

wherein (i) said input gear includes a first input gear teeth set and a

second input gear teeth set which are spaced apart from each other, and

5 (ii) said first input gear teeth set extends outwardly away from said central axis, and (iii) said second input gear teeth set extends inwardly toward said central axis;

a slave gear which is caused to rotate in response to rotation of said input gear; and

10 a mixing blade which is caused to rotate in response to rotation of said slave gear.

44. The bone cement mixing apparatus of claim 43, wherein said

input gear is configured so that during rotation thereof (i) said first input

15 gear teeth set meshingly engages said slave gear during a first period of time, and (ii) said second input gear teeth set meshingly engages said slave gear during a second period of time which is different from said first period of time.

45. The bone cement mixing apparatus of claim 43, wherein:

said central axis lies in a plane which divides said input gear into a first input gear side and a second input gear side,

said input gear is configured so that (i) said first input gear teeth
5 set is positioned entirely on said first input gear side, and (ii) said second input gear teeth set is positioned entirely on said second input gear side.